

CLAIMS

What is claimed is:

- 5 1. A method of removing a detectable portion of a pre-selected contraband substance present on a surface, comprising illuminating said surface with light emitted from an infrared laser, said illumination having sufficient intensity and duration to cause selective desorption of molecules of said contraband substance without substantially damaging
10 said surface.
2. A method as recited by claim 1, wherein said infrared laser emits a continuous infrared beam.
3. A method as recited by claim 1, wherein said infrared laser emits pulses of infrared light.
- 15 4. A method as recited by claim 3, wherein said pulses have a duration ranging from about 5 femtoseconds to 500 microseconds.
5. A method as recited by claim 3, wherein said pulses have a repetition rate ranging from about 10 to 20,000 Hz.
6. A method as recited by claim 1, wherein said light has a spot size on
20 said surface ranging from about 0.1 to 5 mm.
7. A method as recited by claim 1, wherein said laser is a CO₂ gas laser.
8. A method as recited by claim 7, wherein said CO₂ gas in said laser is isotopically enriched.

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9. A method as recited by claim 1, wherein said contraband substance comprises an explosive agent.

10. A method as recited by claim 1, wherein said contraband substance comprises a narcotic agent.

5 11. A method as recited by claim 1, wherein said contraband substance comprises a chemical agent.

12. A method of detecting the presence of a preselected contraband substance on a surface of an object comprising the steps of:

- 10 a. illuminating an interrogation area of said surface with a beam of light emitted from an infrared laser, said illumination having sufficient intensity and duration to cause selective desorption of molecules of said contraband substance present on said surface without substantially damaging said surface;
- 15 b. collecting at least a portion of said desorbed molecules in a collection system;
- c. analyzing said portion in a chemical analysis system, the system being associated with said collection system and comprising a detector responsive to the presence in said chemical analysis system of said contraband substance;
- 20 d. outputting an electrical signal representative of said presence of said contraband substance; and
- e. activating signal means operably connected to said chemical analysis system in response to the output of said electrical signal.

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13.A method as recited by claim 12, wherein said light is emitted continuously.

14.A method as recited by claim 12, wherein said beam is pulsed.

5 15.A method as recited by claim 14, wherein said light is pulsed by a chopper interposed in said beam.

16. A method as recited by claim 14, wherein said laser is a pulsed laser.

17.A method as recited by claim 14, wherein said pulses have a duration ranging from about 5 femtoseconds to 500 microseconds.

10 18.A method as recited by claim 14, wherein said pulses have a repetition rate ranging from about 10 to 20,000 Hz.

19.A method as recited by claim 12, wherein said beam has a spot size on said surface ranging from about 0.1 to 5 mm.

20.A method as recited by claim 12, wherein said laser has a fluence ranging from about 0.5 to 50 mJ/cm².

15 21.A method as recited by claim 12, wherein said laser is a CO₂ gas laser.

22.A method as recited by claim 18, wherein said CO₂ gas in said laser is isotopically enriched.

23.A method as recited by claim 12, wherein said contraband substance comprises an explosive agent.

20 24.A method as recited by claim 20, wherein said explosive agent comprises an organo-nitro explosive compound.

25.A method as recited by claim 12, wherein said contraband substance comprises a narcotic agent.

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26. A method as recited by claim 12, wherein said contraband substance comprises a chemical agent.
27. A method as recited by claim 12, wherein said detector is a GC/IMS detector.
- 5 28. A method as recited by claim 12, wherein said detector is a pyrolysis electrochemical detector.
29. A method as recited by claim 12, wherein said detector is a surface ionization detector.
30. A method as recited by claim 12, further comprising relative motion of
10 said object and said beam of light to illuminate an extended interrogation zone.
31. A method as recited by claim 12, further comprising movably deflecting said light with an optically deflecting component to illuminate an extended interrogation zone.
- 15 32. A method as recited by claim 30, wherein said optically deflecting component is a rotating mirror.
33. A method as recited by claim 30, further comprising moving said object on a conveyor belt.
34. A method as recited by claim 30, wherein said beam of light is raster
20 scanned over said extended interrogation zone.
35. A method as recited by claim 30, further comprising displaying a mapping on a computer display terminal, said mapping being indicative of the locations at which a contraband substance has been detected.

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36. An apparatus for non-destructively detecting the presence of a contraband substance on a surface of an object comprising:

- a. an infrared laser adapted to emit light;
- b. an optical system adapted to deliver a beam of said light emitted from said infrared laser to illuminate an interrogation area of said surface, said illumination having sufficient intensity and duration to cause selective desorption of molecules of said contraband substance present on said surface without substantially damaging said surface;
- c. a collection system adapted to collect at least a portion of said desorbed molecules;
- d. a chemical analysis system associated with said collection system and having a detector responsive to the presence in said collection system of said desorbed molecules and adapted to output an electrical signal representative of said presence of said contraband substance; and
- e. signal means operably connected to said chemical analysis system and responsive to the output of said electrical signal.

37. The apparatus of claim 36, wherein said light is emitted continuously.

38. The apparatus of claim 36, wherein said light is pulsed.

39. The apparatus of claim 38, further comprising a chopper interposed in said beam.

40. The apparatus of claim 38, wherein said laser is a pulsed laser.

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41. The apparatus of claim 38, wherein said pulses have a duration ranging from about 5 femtoseconds to 500 microseconds.
42. The apparatus of claim 38, wherein said pulses have a repetition rate ranging from about 10 to 20,000 Hz.
- 5 43. The apparatus of claim 38, wherein said light has a spot size on said surface ranging from about 0.1 to 5 mm.
44. The apparatus of claim 36, wherein said laser is a CO₂ gas laser.
45. The apparatus of claim 44, wherein said CO₂ gas is isotopically enriched.
- 10 46. The apparatus of claim 36, wherein said contraband substance comprises an explosive agent.
47. The apparatus of claim 46, wherein said explosive agent comprises an organo nitro explosive compound or inorganic nitrate salt.
48. The apparatus of claim 36, wherein said contraband substance
15 comprises a narcotic agent.
49. The apparatus of claim 36, wherein said contraband substance comprises a chemical agent.
50. The apparatus of claim 36, wherein said detector is a GC/IMS detector.
51. The apparatus of claim 36, wherein said detector is a pyrolysis
20 electrochemical detector.
52. The apparatus of claim 36, wherein said detector is a surface ionization detector.
53. The apparatus of claim 36, wherein said optical system comprises at least one deflecting optical component and means for imparting motion

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thereto, the motion of said deflecting optical component changing the location at which said beam impinges on said surface, thereby extending said interrogation zone.

54. The apparatus of claim 36, further comprising translation means adapted to move said object.

55. The apparatus of claim 53, further comprising translation means adapted to move said object.

56. The apparatus of claim 55, wherein said translation means comprises a conveyor belt.

57. The apparatus of claim 55, wherein said beam is raster scanned over said interrogation zone.

58. The apparatus of claim 55, further comprising:

- a. a computer operably connected to said detector, said drive motor, and said translation means;
- b. a computer display terminal associated with said computer;
- c. said computer being adapted to control the operation of said drive motor and said translation means; and
- d. said computer further being adapted to display on said computer display terminal a mapping representative of the positions on said surface at which said contraband substance is detected.

59. A method as recited by claim 12 wherein said intensity and duration of said illumination is not sufficient to cause substantial deflagration or detonation of said substance present on said surface.

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60. A method as recited by claim 23, wherein said explosive agent comprises a plastic explosive.

61. An apparatus as recited by claim 36, wherein said intensity and duration of said illumination is not sufficient to cause substantial deflagration or detonation of said substance present on said surface.

62. An apparatus as recited by claim 46, wherein said explosive agent comprises a plastic explosive.

63. An apparatus as recited by claim 36, wherein said detector is a GC/MS detector.

64. An apparatus as recited by claim 36, wherein said detector is an FIS detector.

65. An apparatus as recited by claim 36, wherein said detector is a gas-phase infrared detector.

66. An apparatus as recited by claim 36, wherein said detector is a photoacoustic detector.

67. A method as recited by claim 20, wherein said explosive agent comprises an inorganic nitrate salt.

68. The apparatus of claim 46, wherein said explosive agent comprises an inorganic nitrate salt.